RHIC spin flipper meeting

Dec. 11, 2007

Meeting of Mei, Peter and Wuzheng

Remaining issues of ac dipole design

- ## Cos? vs. window frame
    - Peter's comment
        - Cos? winding not needed for ferrite magnet. Cos? actually increases path length. Cos? l_e=0.14m
        - Window Frame l_e=Aperture-height=0.12m. Uniform winding is simpler to construct
    - Wuzheng's model on a one turn copper bar window frame
        - N=1 (x2), Io = 480 A, L = 5.1 μH
        - If use solid Cu stripes, loss in conductors: 400 W (39 kHz);
        - $\qquad$ (P = ?J 2/s ds) $\qquad\qquad\qquad$ 480 W (60 kHz)
        - $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (per magnet)

    - **Conclusion: Window frame with Litz wire**

Remaining issues of ac dipole design

- How many turns
  - Tuning range: +-2% of 40kHz~(+-800Hz)
  - Determined by the tuning design
    - Peter prefers to have more turns. So the tuning is reactive because it needs to be outside the tunnel.
    - Wuzheng mentioned that for practice he prefers less turns to reduce the pile-up effect at the two ends for mechanical design and manufacture. Also has an effect on the actual length of the ceramic pipe.
    - The current is the parameter Peter is looking for. According to Peter, the ac dipole peak voltage for 39kHz is 294 volts/per turn, for 61kHz, 460volts/per turn. So, for 12 turns at 65kHz, 5.9kvolt. The goal is to keep 15amps in the cable of the tuning circuit, this is because we can then use similar cable which sends the drive signal of the ac dipole. Since we need a total of 21.7 kvolts-amp reactive power for +-800Hz tuning, the ratio of 21.7Kv-A and 15amp gives 1.45kV which corresponds to 3.2 turns.
    - Conclusion is we stay with 6-8 turns/per magnet. We plan to settle the type of corrector (round or flat) and we will do one more iteration. We will then settle the magnet design.

Remaining issues of ac dipole design

- **High power demonstration of the tuning technique**
  - Schedule? Peter has a preliminary design. He is looking for a heat sink. He also is working on getting the software which controls the low level drive signal. Currently, this requires a lot of of his time to develop. Since Peter is also working on many other projects, we need either to get someone to help him or to decide what's the priority of this work relative to the others
- **Shopping list**
  - Ceramic beam pipe+flange
  - Coil (litz wire: round or flat)
  - Ferrite: thickness: 1inch to keep the peak field in the ferrite at a certain level
  - Capacitors: later
  - Switches: later